

A strategy to implement and fund a long-term, multi-purpose
New Hampshire Stream Gage Network

Developed by the
New Hampshire
Stream Gage Task Force

for the
Commissioner
Department of Environmental Services

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List of Acronyms Used in this Report:

ACOE – US Army Corps of Engineers

HDCN – Hydrologic Data Collection Network [NHDES data collection gage]

HUC – Hydrologic Unit Code [watershed identifying number]

NHDES – New Hampshire Department of Environmental Services

RMAC – Rivers Management Advisory Committee (RSA 483)

SGN – Stream Gage Network

SGTF – Stream Gage Task Force

TMDL – Total Maximum Daily Load (EPA Clean Water Act program)

USGS – United States Geological Survey

1.0 INTRODUCTION

New Hampshire has been losing stream gages since 1969 and by 2007 the stream gage network will be at its lowest numbers since 1939. Recognizing the drastic loss of 14 stream gages in 2004-2005 that resulted from impermanent funding sources, the Rivers Management Advisory Committee determined the need for a strategy to implement and fund a long-term, multi-purpose Stream Gage Network within the state.

Based on the RMAC's recommendation, the Stream Gage Task Force was formed in March 2006 by order of the Commissioner of New Hampshire Department of Environmental Services. The SGTF, representing a diverse range of existing and potential gaging data users, met and corresponded frequently between April and September 2006 to evaluate the state's current SGN and identify any vital data needs that are not being met. This report concludes the SGTF's assessment and includes proposed gage locations for meeting unmet needs.

Stream gaging is the monitoring of stream flow and its variation over time, based on measurements of stream stage (height) and velocity. Flow monitoring is a fundamental component of data collection efforts that are vital to both environmental protection and economic growth and stability. Gaging data is used by many users for many different purposes including flood prediction, drinking water supply studies, transportation corridor design, hydroelectric power production, recreational activities, fisheries maintenance, etc.

Effective and scientifically defensible management of water resources requires that stream gages be maintained continuously over a period of many years in a broad variety of geographic settings throughout the state. This is especially important as watershed stresses increase in high water use areas such as the Seacoast region. However, continuous long-term gaging is also vital for documenting baseline conditions in more rural watersheds.

A stable and sufficient long-term SGN is needed to meet these challenges and provide critical flow data. This document identifies those critical data needs and includes recommendations for implementing changes to the SGN that would allow New Hampshire to more effectively manage water resources for the 21st century. The SGTF further recommends that stable funding sources should be developed to implement this network.

2.0 STATUS OF THE NH STREAM GAGE NETWORK

The types of stream gages used in New Hampshire are:

- ❑ **Continuous record gages** measure river stage that is converted to stream flow by a rating curve maintained for the entire range of flows. A rating curve is a relationship between stage and flow.
- ❑ **Partial record gages** measure river stage but only some of the data is converted to stream flows—usually the high or the low flow range—using a rating curve that covers only that part of the range of flows.
- ❑ **Stage-only gages** measure only the river height. No rating curve is available to convert stage data to flow.

- ❑ **Hydrologic Data Collection Network gages** are operated independently by NHDES Dam Bureau for flood control and reservoir management. HDCN data are not corrected nor are the rating curves maintained, and therefore cannot be categorized as either a continuous record or partial record.

Federal, state and local entities currently fund the operation of 41 continuous record gages as well as six partial record gages and three stage-only gages. These gages are operated by the U.S. Geological Survey.

Over the years, the numbers of USGS-operated gages and their sources of funding have fluctuated. Recently, those fluctuations have taken a steep downward trend. In 2003, there were 53 continuous record gages operating in New Hampshire (including a Connecticut River gage in Vermont). By 2007, there will be only 37 of these gages left.

Around 1990, six continuous record gages were converted to partial record gages reflecting the US Army Corps of Engineers need for flood control data only. In 2002, seven gages were converted from partial to continuous record with federal funding from the National Streamflow Information Program, including three of the gages that had been formerly downgraded to meet ACOE needs.

In the last two years, reductions in hydropower generation income to the state resulted in loss of funds for meeting federal match requirements. The loss of funding resulted in the reduction of federal support staff and closing of 14 gage stations in 2004 and 2005 (12 continuous and two partial record gages). NHDES Dam Bureau independently now operates seven of these former USGS gage stations under its HDCN program for flood control and reservoir management.

USGS sometimes collects continuous record gage data for short durations—10 to 25 years—and then replaces the gages at other locations. In addition, sometimes gages are installed on a temporary basis for project purposes or as the most efficient means of collecting data statewide. The following five existing continuous-record gages are scheduled to close in 2006 and 2007:

- ❑ 01072870 ISINGLASS R AT ROCHESTER NECK RD, NR DOVER, NH
- ❑ 01073460 NORTH RIVER ABOVE NH 125, NEAR LEE, NH
- ❑ 01073822 LITTLE RIVER AT WOODLAND ROAD, NEAR HAMPTON, NH
- ❑ 1073785 WINNICUT RIVER AT GREENLAND, NR PORTSMOUTH, NH
- ❑ 11005605 POLICY BR @ I-93N REST STOP ENT RAMP, NR SALEM, NH

The first four continuous record gage stations listed above were installed for the joint USGS-NHDES Seacoast Groundwater Availability Project. The first three will be discontinued on September 30, 2006 unless a new source of funding is established. All three were identified as meeting vital long term data needs. The first two are in Designated River watersheds^[1], and the last is in a developed watershed with high water demands. The last two project gages on this list have funding through 2007. The Winnicut gage provides data in a developed watershed with high water demands. The Policy Brook gage continues to have value for the critical I-93 corridor chloride loading study.

2.1 Other States

While New Hampshire's SGN has been receiving less and less support, the following New England states have been actively improving their stream gage programs.

- ❑ **Vermont:** Generally adds one to two gages a year; Vermont has added ten gages between 2000 and 2005.
- ❑ **Massachusetts:** Is scheduled during 2006-2008 to add 25-30 new stream gages. These new gages will provide additional stream flow information in coastal and other areas where the growing demand for water is competing with the need to maintain adequate stream flow for aquatic habitat protection. When all new gages are installed, the Massachusetts gaging network will include a total of approximately 125 gages.
- ❑ **Rhode Island:** Had 19 gages in 2004 and determined that their needs could be met by installing 24 new gages, converting nine project gages to permanent gages, and reestablishing two discontinued permanent gages. They are adding a few gages per year to meet this goal.
- ❑ **Maine:** Expects to lose two gages this year due to reductions in federal funding, but had grown from 51 to 62 continuous stream flow gages between 1999 and 2004.

2.2 HUC-10 Watersheds

New Hampshire is divided into 81 watersheds (at the 10-digit Hydrologic Unit Code^[2] [HUC-10] scale) that are partially or completely within the state boundaries. Stream flow data from strategic locations within each of these watersheds would be ideally suited for developing comprehensive water budgets. Water budgets would show the movement and availability of water on statewide and local scales.

In 2006, 45 of these HUC-10 watersheds currently have some form of stream flow measurements. In 35 of those watersheds, continuous record measurements are collected and internet-available from 41 USGS stations. Four of the watersheds have only partial record or stage-only gages, and the remaining six have seven HDCN gages.

Of the 46 HUC-10 watersheds without continuous gages, 38 have registered water users and 18 have more than ten water users registered. Registered water users are water users who have registered their withdrawal, transfer, or discharge of over 140,000 gallons per week. Water use at this scale includes water utilities, hydropower dams, agricultural and golf course irrigation, waste water treatment facilities, etc., but not homeowners.

Several ungaged watersheds have valuable historic gaging sites that have been discontinued due to funding limitations.

Many of the ungaged watersheds are in the northern, more rural portion of the state where flow information is needed to assess conditions prior to further development. However, some of the ungaged watersheds are in the southern portion of the state where population pressures are growing and flow data is needed to assess the impact of that growth.

2.3 Data Availability

An important distinction between the various types of gages is the timely availability of flow data. This study uses USGS continuous gages as the basic measure of data collection, quality

and availability. Data are available as daily mean flow for the period of record via the internet for all active and inactive continuous gages. These gages generally collect 15-minute flow values that are available in real-time for immediate retrieval from the USGS web page.

USGS partial record and stage-only gages and NHDES HDCN gages also provide real-time data, but their data are not immediately available via the internet after 31 and 14 days, respectively. USGS does not publish daily mean flow values for partial record gages and USGS stage-only gages provide only certain flow parameters.

HDCN stations are limited by quality assurance and data availability issues. Archived HDCN data can be requested from NHDES. These data have the potential to be posted to the NHDES Environmental Monitoring Database, which would make data quickly available via the internet for the period of record. Data quality improvements, increased availability of data records, and additional data collection station locations are being evaluated by NHDES.

3.0 DESCRIPTION OF ASSESSMENT PROCESS

As noted above, SGTF members represent a diverse range of existing and potential gaging data users. Each SGTF member was asked to evaluate their needs for stream flow data that are supported by the existing network and then to propose additional locations for stream gages to meet data needs.

3.1 Existing Network

Evaluation of the existing SGN began with the list of USGS and HDCN gages currently providing data for New Hampshire waters (Table 1). A list of categories was developed to identify the uses made of the gage data. These categories included four real time data uses and four historical data uses.

Real-time data uses:

- Flood control and response
- Reservoir management
- Flow availability
- Water-related permit conditions implementation and monitoring

Historical-time data uses:

- Water availability and flow assessments
- Hydrologic trends and statistical assessments such as climate change, and regression analysis for ungaged streams
- Hydraulic design and geomorphology studies
- Waste and water chemistry assessments

Task force members evaluated the list of USGS and HDCN gages for their specific data uses under these categories. Members also identified the gages as either 1) vital, 2) supporting their data need, or 3) in need of improvement. Each member then identified whether a permanent or a temporary gage would support their purpose and whether the purpose required continuous or partial record data.

3.2 Proposed Network

SGTF members unanimously agreed that additional gaging is needed to improve the state's network. Members identified their proposed locations and then categorized the real-time or historical-time data uses each proposed gage would meet for their uses. Each proposed gage was further identified as either currently needed or an anticipated future need. Each member then identified whether a permanent or a temporary gage would support their purposes, and whether continuous or partial record data was needed.

The SGTF reviewed an initial list of the proposed gages. SGTF members had made 116 proposals for additional gage locations and these were further sorted to avoid duplication. The result was a composite list of 61 locations in 35 HUC-10 watersheds. In some cases, more than a single location was proposed per watershed.

Each HUC-10 watershed with a proposed gage was then scored. All 116 proposals were weighted as follows.

- ❑ Proposed gages identified as **immediate** needs were weighted as a 3.
- ❑ Proposed gages identified as **future** needs were weighted as a 1.
- ❑ The HUC-10 watersheds were then ranked by the sums of these values. The highest score ranked as the highest priority for gaging.

The SGTF determined that this ranking represents the overall consensus of the committee of the most vital stream gage needs providing the most benefit to the long-term network and its data users. If funding is provided and more than one location within a watershed was recommended, further assessment of the gage priorities may be required.

4.0 SGTF FINDINGS FOR THE EXISTING NH GAGE NETWORK

In summary, the SGTF assessment shows that all of the existing gages currently support vital data needs. As part of the assessment, SGTF members identified their needs and uses for stream flow gaging from the population of existing USGS continuous, partial record and stage-only gages, plus the NHDES HDCN gages. The results of the assessment are shown in Appendix A - Table 1.

4.1 Recommendation

The SGTF recommends maintaining all existing gages including the five scheduled to close by the next year. Each of the gages supports four or more vital needs of the responding members except for the Little River and Winnicut River gages. Both of these gages are being used to make water management decisions in high-use watersheds on the coast. The uses of the other three gages that are closing have been identified above.

Continuous record gages were identified as the predominant data need. Partial record gages are used by two data users who identified 11 gages used for low-flow data and four for high-flow data. All gages identified with a partial record need also had other users who identified a need for continuous record gage data.

5.0 SGTF PROPOSALS FOR MEETING VITAL GAGE DATA NEEDS

The SGTF identified data gaps in the existing network and recommended locations to fill those data gaps (Table 2). SGTF found that proposals for gages fell into three main areas of need.

- ☐ Gages for Designated Rivers
- ☐ Gages in watersheds with near natural conditions
- ☐ Gages for assessments required to evaluate water availability and wastewater disposal conditions—usually in heavily developed or growing watersheds

All proposed sites were for continuous record gages, and all but three of these were for permanent installations. Proposed locations represent 35 HUC-10 watersheds of which 21 currently have no existing continuous USGS gages or NHDES HDCN gage.

The reported uses of the gage data show that the traditional needs for flood control and research purposes are still vital for data users. For these purposes, stream gages are located to meet certain physical or climatological characteristics. However, the SGTF concluded that flow data will increasingly be used for water management purposes. These data needs tend to require gages at locations specific to water use activities.

In addition to the watershed-specific proposals, SGTF members identified some general gaging location needs in support of fish and game habitat management and for statistical assessments

- ☐ Watersheds of very small size (e.g., <2 sq miles) or moderate size (e.g., 30-75 sq miles)
- ☐ Watersheds with steep slopes or high elevations
- ☐ Unregulated (naturally-flowing) watersheds
- ☐ Downstream of hydropower dams

Where possible, these needs should be considered in the prioritization of potential gage locations. Some of these needs would be met by the watershed-specific proposals.

5.1 Recommendation

The Task Force recommends adding gages to the existing network in the 17 highest priority HUC-10 watersheds (as shown in Table 1) to meet critical data needs. This recommendation would place continuous gages in eight watersheds that have none (including one with its gage closing in 2006) and three that have only stage-only or partial record gages. The Task Force further recommends that a permanent stable source of funding be established to expand the existing SGN and replace funding sources currently based on revenue generation.

Table 1 - Stream Gages in the NH Network (9/15/06)

Gage Status	HUC -10 Index (6)	USGS or NHDES Gage Station number	Existing gage names
Continuous (1)	A3	01052500	DIAMOND RIVER NEAR WENTWORTH LOCATION, NH
Continuous	A5	01053500	ANDROSCOGGIN RIVER AT ERROL, NH
Continuous	A5	01054000	ANDROSCOGGIN RIVER NEAR GORHAM, NH
HDCN (2)	C1	SFMNH	MILTON 3-PONDS (Formerly 01072100 SALMON FALLS RIVER AT MILTON, NH)
Continuous	C2	01072800	COCHECO RIVER NEAR ROCHESTER, NH.
Closing - Continuous(3)	C2	01072870	ISINGLASS R AT ROCHESTER NECK RD, NR DOVER, NH
Closing - Continuous	C3	01073460	NORTH RIVER ABOVE NH 125, NEAR LEE, NH
Continuous	C3	01073500	LAMPREY RIVER NEAR NEWMARKET, NH
Continuous	C4	01073587	EXETER RIVER AT HAIGH ROAD, NEAR BRENTWOOD, NH
Continuous	C5	01073000	OYSTER RIVER NEAR DURHAM, NH
Closing - Continuous	C5	01073785	WINNICUT RIVER AT GREENLAND, NR PORTSMOUTH, NH
Closing - Continuous	C6	01073822	LITTLE RIVER AT WOODLAND ROAD, NEAR HAMPTON, NH
Continuous	Ct10	01131500	CONNECTICUT RIVER NEAR DALTON, NH
Continuous	Ct12	01137500	AMMONOOSUC RIVER AT BETHLEHEM JUNCTION, NH
Continuous	Ct14	01138500	CONNECTICUT RIVER AT WELLS RIVER, VT
HDCN	Ct17	MCAN3	MASCOMA LAKE (Formerly 01150500 MASCOMA RIVER AT MASCOMA, NH)
HDCN	Ct17	WCNN3	MASCOMA RIVER (Formerly 01145000 MASCOMA RIVER AT WEST CANAAN, NH)
Continuous	Ct18	01144500	CONNECTICUT RIVER AT WEST LEBANON, NH
Continuous	Ct19	01152500	SUGAR RIVER AT WEST CLAREMONT, NH
Continuous	Ct2	01129200	CONNECTICUT R BELOW INDIAN STREAM NR PITTSBURG, NH
Continuous	Ct22	01154500	CONNECTICUT RIVER AT NORTH WALPOLE, NH
Continuous	Ct23	01158000	ASHUELOT RIVER BELOW SURRY MT DAM, NEAR KEENE, NH
Continuous	Ct24	01158600	OTTER BROOK BELOW OTTER BROOK DAM, NEAR KEENE, NH
Stage-only (4)	Ct25	01158110	ASHUELOT RIVER ABOVE THE BRANCH, AT KEENE, NH (stage only)
Continuous	Ct26	01160350	ASHUELOT RIVER AT WEST SWANZEY, NH
Continuous	Ct26	01161000	ASHUELOT RIVER AT HINSDALE, NH
Continuous	Ct5	01129500	CONNECTICUT RIVER AT NORTH STRATFORD, NH
Continuous	M1	01074520	EAST BRANCH PEMIGEWASSET RIVER AT LINCOLN, NH
Continuous	M10	01081000	WINNIPESAUKEE RIVER AT TILTON, NH

Continuous	M11	01082000	CONTOOCOOK RIVER AT PETERBOROUGH, NH
PR (5)	M11	01083000	NUBANUSIT BK BLW MACDOWELL DAM NR PETERBOROUGH NH (partial record0
Continuous	M13	01086000	WARNER RIVER AT DAVISVILLE, NH
PR	M14	01087000	BLACKWATER RIVER NEAR WEBSTER, NH (partial record)
PR	M15	01085000	CONTOOCOOK RIVER NEAR HENNIKER, NH (partial record)
Continuous	M15	01085500	CONTOOCOOK R BL HOPKINTON DAM AT W HOPKINTON, NH
Stage-only	M15	01087850	CONTOOCOOK RIVER AT RIVER HILL, NEAR PENACOOK, NH (stage only)
Continuous	M18	01081500	MERRIMACK RIVER AT FRANKLIN JUNCTION, NH
Continuous	M19	01089100	SOUCOOK RIVER, AT PEMBROKE ROAD, NEAR CONCORD, NH
Continuous	M2	01075000	PEMIGEWASSET RIVER AT WOODSTOCK, NH
Stage-only	M20	01088400	MERRIMACK RIVER AT CONCORD, NH (stage only)
PR	M23	01090800	PISCATAQUOG RIVER BL EVERETT DAM, NR E WEARE, NH (partial record)
PR	M23	01091500	PISCATAQUOG RIVER NEAR GOFFSTOWN, NH (partial record)
Continuous	M25	01092000	MERRIMACK R NR GOFFS FALLS, BELOW MANCHESTER, NH
Continuous	M26	01094000	SOUHEGAN RIVER AT MERRIMACK, NH
Continuous	M28	01100505	SPICKET RIVER AT NORTH SALEM, NH
PR	M28	01100561	SPICKET RIVER NEAR METHUEN, MA (partial record)
Closing - Continuous	M28	011005605	POLICY BR @ I-93N REST STOP ENT RAMP, NR SALEM, NH
Continuous	M29	010965852	BEAVER BROOK AT NORTH PELHAM, NH
Continuous	M3	01076000	BAKER RIVER NEAR RUMNEY, NH
Continuous	M4	01076500	PEMIGEWASSET RIVER AT PLYMOUTH, NH
HDCN	M5	ASHNH	SQUAM RIVER AT ASHLAND, N.H. (formerly 01077000)
HDCN	M6	NFLNH	NEWFOUND LAKE DAM (formerly 01077500 Newfound Lake Near Bristol, NH)
Continuous	M7	01078000	SMITH RIVER NEAR BRISTOL, NH
HDCN	M9	LKPN3	LAKE WINNIPESAUKEE OUTLET AT LAKEPORT, N.H. (formerly 01080500)
Continuous	S3	01064500	SACO RIVER NEAR CONWAY, NH
Continuous	S5	01064801	BEARCAMP RIVER AT SOUTH TAMWORTH, NH
HDCN	S8	OSRNH	OSSIPEE RIVER AT EFFINGHAM FALLS, N.H. (formerly 01065000)
	(6) Index - for this study USGS HUC-10 numbers were renamed with the first letter of their major basin and sequential numbering.		
	A=Androscoggin, C=Coastal, Ct=Connecticut, M=Merrimack, S=Saco		
(1) Continuous = USGS continuous record gage (measurements accurate for full range of high and low flows)			
(2) HDCN = Hydrologic Data Collection Network (NHDES Dam Bureau station)			
(3) Closing - Continuous = Continuous gages without funding after either 2006 or 2007			
(4) Stage-only = USGS water height measurement station			
(5) PR = USGS partial record gage (measurements accurate only for some of the data such as the high or low flows)			

**Table 2 – Proposed Gage Recommendations
Highest Priority HUC-10s**

Priority Ranking	HUC 10 Index	HUC-10 results of sum of revalued priority of proposals for gages	HUC-10 name
1	M23	40	PISCATAQUOG RIVER - One or more gages located on any of the three branches or main stem of the Piscataquog River system, especially South Branch, [two partial record gages at 01090800 below Everett Dam (DA=63.1 mi ²) and 01091500 near Goffstown (DA=202 mi ²)]
2	M26	20	SOUHEGAN RIVER - upper Souhegan to support the Water Management Plan under the Instream Flow Pilot Program, DA < or =50 mi ² [existing USGS gage in lower watershed 01094000 Souhegan R. at Merrimack - DA=171 mi ²]
3	Ct21	14	COLD RIVER - DA= 82.7 mi ² , unregulated watershed, NH Designated River, former USGS gage 1155000, high-priority USFWS salmon nursery, flash flood-prone; site of 500+ year flood in October 2005, [no existing gage]
4	C3	10	LAMPREY RIVER - upstream of Raymond. Needed for NPDES permitting and compliance issues for possible new POTW in Raymond; <u>and</u> North River, 01073460 North River nr Lee, [this is an existing gage, but closing 9/30/06], DA=35.6 mi. ² , unregulated tributary to the Lamprey River [existing USGS gage in lower watershed 01073500 Lamprey at Packers Falls (DA=183 mi ²)]
4	Ct25	10	MIDDLE ASHUELOT RIVER - reactivate 01160000 South Branch Ashuelot nr Webb, nr Marlborough, DA=36.0 mi. ² , (or install new gage higher in watershed), needed for NPDES permitting and compliance issues with the Troy POTW, unregulated watershed, [existing stage-only gage on main stem at 01158110 Ashuelot River above the Branch at Keene, DA=214 mi. ²]

4	Ct6	10	UPPER AMMONOOSUC RIVER - reactivate former gage 1130000 Upper Ammonoosuc R. near Groveton, NH, DA=232 mi ² , [no existing gage]
4	S1	10	UPPER SACO RIVER - on upper 21 miles for better coverage of the Designated River; <u>and</u> Rocky Branch, unregulated watershed and trib. to Saco R near N Conway; <u>also</u> former USGS gage 01064300 Ellis River nr Jackson, NH, DA=10.9 mi. ² , unregulated, small high elevation watershed, [no existing gage]
4	S2	10	SWIFT RIVER - very little water use and no dams, unregulated watershed, high precipitation watershed fills gap in this coverage, Designated River and trib. to Designated Saco R., watershed is 87.1 mi ² , [no existing gage]
5	C4	9	EXETER RIVER - reactivate 1073600 Dudley Br. Exeter, NH, DA=5.86 mi ² ; <u>and</u> Squamscott River (Newmarket, Newfields, Exeter area) coastal; <u>also</u> upper Exeter River to support water use assessments on the upper 9 miles of Designated River, [existing USGS gage in lower watershed- 01073587 Exeter R. at Haigh Rd, 63.5 mi ²]
5	M12	9	NORTH BRANCH (Contoocook R.) - Beards Br. nr Hillsborough, NH, unregulated trib to Contoocook, former USGS gage 1084500, DA=55.4; <u>and</u> North Branch of the Contoocook. Designated River and trib. to Contoocook (Designated) River main stem [no existing gage]
6	C2	8	COCHECO RIVER - 01072870 Isinglass River nr Dover, NH, DA=73.6, NH Designated River, upstream from landfill site, [this is an existing USGS gage, but closing 9/30/06]; <u>and</u> upper Isinglass, segment on the Designated River
7	M13	7	WARNER RIVER - West Branch Warner River nr Bradford, NH, DA= 5.75, unregulated small watershed, [existing USGS gage - 01086000 Warner R. at Davisville, DA=146 mi ²]
8	Ct23	6	UPPER ASHUELOT RIVER - Ashuelot R. former USGS gage 1157000, DA=71.1 mi ² , unregulated watershed, headwaters of Designated River; <u>and</u> upper Ashuelot River, 28 miles that are poorly gaged, may represent a small, relatively unimpacted watershed for a reference gage, [existing USGS gage 01158000 Ashuelot below Surry Man. Dam near Keene (DA=102 mi ²)]
8	M22	6	SUNCOOK RIVER - reactivate gage in North Chichester or install new one in Pittsfield upstream of POTW, needed for NPDES permitting and compliance issues with the Pittsfield POTW, recent flooding issue or Allenstown/Epsom/Pittsfield area, regulated stream [no existing gage]

9	Ct13	5	LOWER AMMONOOSUC RIVER - reactivate former USGS gage 01138000 Ammonoosuc River nr Bath, DA=395 mi ² , needed for NPDES permitting and compliance issues with the Littleton POTW and Lisbon POTW, unregulated; <u>and</u> Wild Ammonoosuc River, unregulated high elevation site [no existing gage]
9	M20	5	CONCORD TRIBUTARIES - upgrade existing Merrimack River at Concord, NH gage, which is currently stage only, to supports flow assessments related to the PSNH Amoskeag releases, many large withdrawals and returns and the closest gages are at Franklin and Manchester. [existing stage-only gage 01088400 Merrimack at Concord (DA= 2,300 mi ²)]
9	M3	5	BAKER RIVER - 1075800 Stevens Br. near Wentworth, NH, DA=3.29 mi ² ; <u>and</u> a temporary gage at 01075500 Baker River nr Wentworth, NH, DA=58.8, unregulated watershed. [existing USGS gage 01076000 Baker R. near Rumney (DA=143 mi ²)]
Priority HUC-10 Watersheds			
Priority Ranking	HUC 10 Index	HUC-10 results of sum of revalued priority of proposals for gages	HUC-10 name
10	A6	4	GORHAM-SHELBURNE TRIBUTARIES - Moose River, Gorham area, trib. to Androscoggin abv Town, significant ungaged watershed; <u>and</u> Peabody River, Gorham area, trib. to Androscoggin bel. Town, , significant ungaged [no existing gage]
10	Ct16	4	CONNECTICUT RIVER-OMPOMPANOOSUC RIVER TO WHITE RIVER - 1141800 Mink Br. Etna, NH, DA=4.88 mi ² , [no existing gage, but main stem CT River has a gage just D/S]
10	Ct4	4	CONNECTICUT RIVER-MOHAWK RIVER TO NULHEGAN RIVER - reinstall 01129440 Mohawk River nr Colebrook, NH, DA=36.7, unregulated tributary to CT R, [no existing gage, but main stem CT River has a gage just D/S]

10	Ct9	4	JOHNS RIVER - upstream of the Whitefield POTW, needed for NPDES permitting and compliance issues with the Whitefield POTW, unregulated watershed, [no existing gage]
10	M15	4	LOWER CONTOOCOOK RIVER - upgrade stage-only gage 01088000 Contoocook River nr Penacook, NH, DA=766 mi ² , nr mouth, NH Designated River [partial record gage 01085000 near Henniker (DA= 368 mi ²), and stage-only gage 01087850 near Penacook (DA=766 mi ²)]
10	M4	4	MIDDLE PEMIGEWASSET RIVER - Mad River, needed for NPDES permitting and compliance issues with the Waterville Valley POTW, [existing USGS gage 01076500 Pemigewasset at Plymouth (DA=623 mi ²)]
10	S3	4	CONWAY TRIBUTARIES - former USGS gage 1064400 Lucy Br. near No. Conway, NH, DA=4.68 mi ² , [existing USGS gage 01064500 Saco near Conway (DA=385 mi ²)]
11	C5	3	GREAT BAY DRAINAGE - 01073785 Winnicut River nr Portsmouth, NH, DA=14.1, located near mouth at 1st dam at head of tide, [this is an existing gage, but closing 2007]
11	Ct1	3	CONNECTICUT LAKES DRAINAGE - former USGS gage 1127880 Big Brook, DA=6.52 mi ² ; <u>and</u> upper reaches (18 miles) of the Connecticut River [no existing gage]
11	Ct12	3	AMMONOOSUC RIVER - Ammonoosuc River - Bethlehem - coverage lacking in a high growth potential area [existing USGS gage 01137500 Ammonoosuc at Bethlehem Jct. (DA=88.2 mi ²)]
11	Ct19	3	SUGAR RIVER - Sugar River - Sunapee - coverage lacking in a high growth potential area, [existing USGS gage 01152500 Sugar R. at W. Claremont, at bottom of watershed (DA= 270 mi ²)]
11	Ct24	3	THE BRANCH (Ashuelot) - temporary gage at Beaver Brook, Keene, DA=5.9, flows through center of Keene, trib. to Ashuelot River [existing USGS gage 01158600 Otter Brook near Keene (DA= 47.2 mi ²)]
11	M2	3	UPPER PEMIGEWASSET RIVER - Hubbard Brook, Woodstock, NH, research area, to resolve how observations of hydrologic processes translate from small watersheds to river basins in order to address environmental issues at the landscape/management scale. The proposed gage location drains a 100% forested watershed, [existing USGS gage 01075000 Pemigewasset at Woodstock (DA= 195 mi ²)]
11	M29	3	MERRIMACK RIVER-NASHUA RIVER TO SHAWSHEEN RIVER - Beaver Brook - Derry - Water chemistry loading assessments for chloride related to I-93

			[existing USGS gage]
11	M30	3	MERRIMACK RIVER-SHAWSHEEN RIVER TO MOUTH - Powwow River, Kingston/South Hampton area, regulated stream [no existing gage]
12	Ct11	1	GALE RIVER - Gale River, unregulated site [no existing gage]
12	Ct15	1	CONNECTICUT RIVER-WAITS RIVER TO HEWES BROOK - Eastman Brook in Piermont upstream of Piermont POTW, needed for NPDES permitting and compliance issues with the Piermont POTW, [no existing gage, but main stem CT has gages U/S and D/S]
12	Ct18	1	CONNECTICUT RIVER-WHITE RIVER TO SUGAR RIVER - Blood Brook in Plainfield upstream of Meriden POTW. Needed for NPDES permitting and compliance issues with the Meriden POTW, [no existing USGS gage, but gage U/S on CT R main stem]
12	Ct3	1	MOHAWK RIVER-STEWARTSTOWN TRIBUTARIES - former USGS gage 1129300 Hall Stream near East Hereford, Quebec, DA=85 mi ² [no existing gage]
12	Ct7	1	ISRAEL RIVER - temporary gage on Israel River, Lancaster/Jefferson area, unregulated site, [no existing gage]
12	M11	1	UPPER CONTOOCCOOK RIVER - Designated River, several short segments on the Contoocook that are not well covered with a gage. Also, there are many water users on this river: there are several dams that cause ungaged variations in river flows, [existing partial record gage 01083000 Nubanusit Brook (DA= 45.1 mi ²)]
12	M6	1	NEWFOUND RIVER - Cockermouth River, natural watershed, inflow to Newfound lake, [existing HDCN gage NFLNH - Newfound Lake Dam, formerly USGS 01077500 (DA= 98 mi ²)]

NH HUC-10 Watershed Stream Gage Coverage

Existing and Proposed by Stream Gage Task Force

September 2006



Active Gages

- USGS Continuous Gage
- ▲ NHDES HDCN
- Massachusetts Stream Gage
- Maine Stream Gage

Hydrography

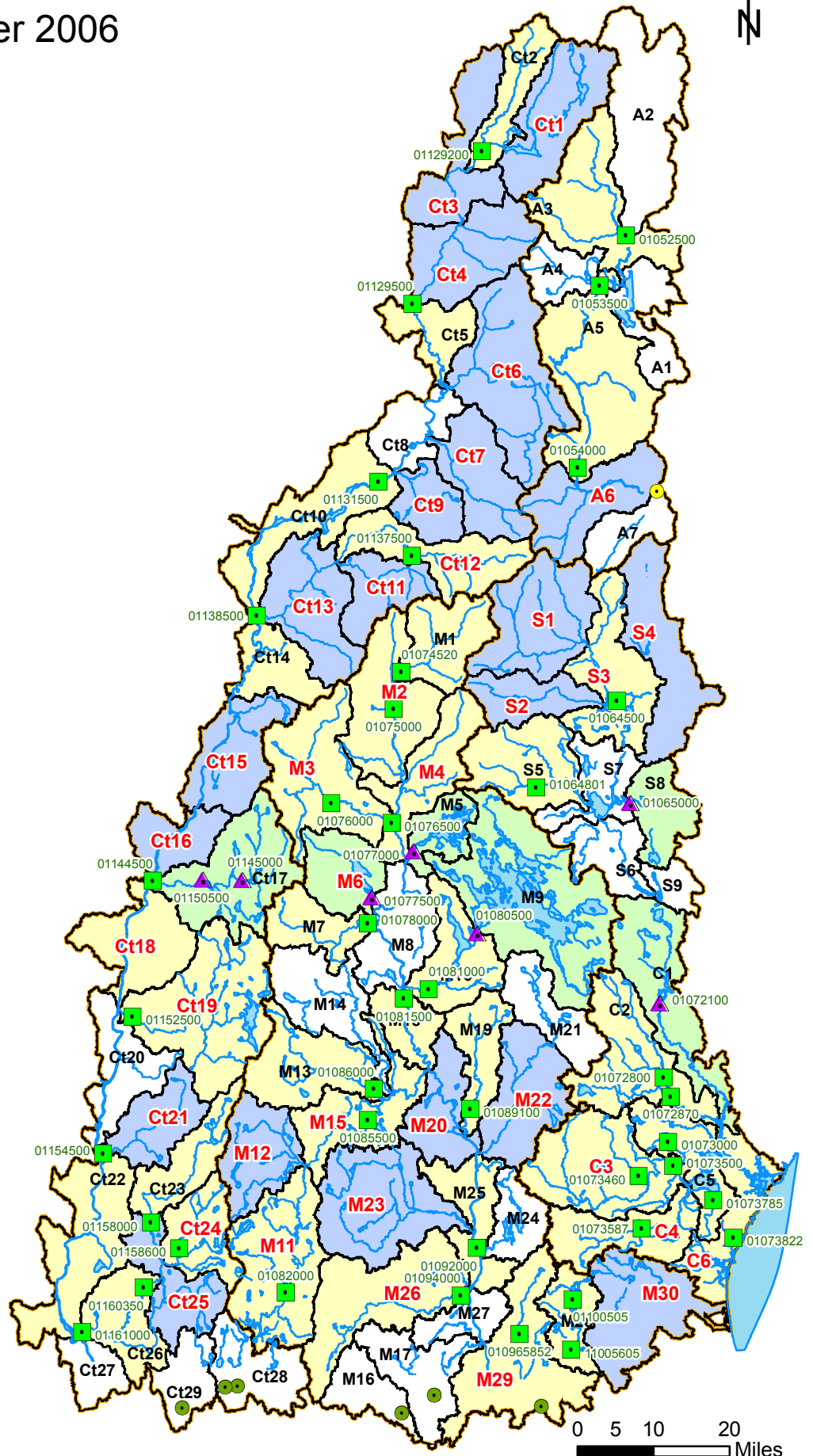
- ~ Rivers/ Streams
- Lakes/ Ponds

HUC_10 Gage Coverage

- No Gage
- Existing HDCN
- Existing USGS
- Proposed New

HUC-10 Index

- A3 No Proposed Gage(s)
- Ct3 Proposed Gage(s)



The coverages presented are under constant revision as new sites or facilities are added. They may not contain all of the potential or existing sites or facilities. NHDES is not responsible for the use or interpretation of this information. Not intended for legal purposes.



Available References

New Hampshire's Stream-gaging Network: Status and Future Needs by S.A. Olson, FS-050-03,
http://pubs.usgs.gov/fs/fs-050-03/pdf/FS050-03_508.pdf

Effectiveness of the New Hampshire Stream-gaging Network in Providing Regional Streamflow Information by S.A. Olson, WRIR 03-4041
<http://pubs.usgs.gov/wri/wrir03-4041/>

A Stream-gaging Network Analysis for the 7-Day, 10-Year Annual Low Flow in New Hampshire Streams by R.H. Flynn, WRIR 03-4023
<http://pubs.usgs.gov/wri/wrir03-4023/>

Development of Regression Equations to Estimate Flow Durations and Low-Flow-Frequency Statistics in New Hampshire Streams by R.H. Flynn, WRIR 02-4298 <http://pubs.usgs.gov/wri/wri02-4298/>

The New Hampshire Watershed Tool: A Geographic Information System Tool to Estimate Streamflow Statistics and Ground-Water Recharge Rates by S.A. Olson, R.H. Flynn, C.M. Johnston, and G.D. Tasker, OFR 2005-1172
<http://pubs.usgs.gov/of/2005/1172/>

Cost Effectiveness of the U.S. Geological Survey's Stream-Gaging Programs in New Hampshire and Vermont by J.A. Smath and F.E. Blackey, WRIR 85-4173

Expansion of the USGS Cooperative Streamgage Network in Massachusetts
<http://ma.water.usgs.gov/nwis/images/coea.expansion.htm>

New Hampshire-Vermont Water Science Center Newsletter, April 2006, USGS publication,
http://nh.water.usgs.gov/Publications/online_publications.htm

List of gages discontinued in 2004: <http://nh.water.usgs.gov/WaterData/NHdiscont05.htm>

Rivers Management Advisory Committee Strategy for Stream Gaging in New Hampshire, December 20, 2005

Rivers Management Advisory Committee Recommendations For Stream Gaging In New Hampshire To the Commissioner of the Department of Environmental Services, December 20, 2005

Footnotes:

^[1] Rivers are **designated** under RSA 483: New Hampshire Rivers Management and Protection Program. There are 14 rivers in NH designated for special protections because of their unique and outstanding characteristics.
<http://www.des.state.nh.us/rivers/rsa483.htm>

^[2] The USGS's **Hydrologic Unit Codes** are numbers that divide the nation's watersheds on a hierarchical basis with an increasing number of digits from regional to more local watersheds. The Merrimack basin has a four-digit HUC (0107) and therefore is a HUC-4. In the Merrimack basin, HUC-0107000609 (a ten-digit HUC) is the Souhegan watershed, which is a subdivision of the Merrimack watershed. New Hampshire is part of four HUC-4s, but is part of 81 HUC-10s. For simplicity of mapping in this report these 10-digit HUCs were renamed with HUC index values made up of a letter indicating the major water watershed and sequential numbering.